Geophysical Research Abstracts, Vol. 7, 09341, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09341
© European Geosciences Union 2005

Dynamics of diffuse CO_2 emission from Cumbre Vieja volcano, La Palma, Canary Islands

A. Alfaya (1), A. Concepción (1), I. Martín (1), **E. Padrón** (2), P. A. Hernández (2) and N. M. Pérez (2)

(1) Chemistry Faculty, University of La Laguna, Avda. Astrofísico Francisco Sánchez, s/n Campus de Anchieta 38206 La Laguna, Tenerife, Canary Islands, Spain, (2) Environmental Research Division, ITER, Pol. Ind. de Granadilla, 38611, Tenerife, Canary Islands, Spain, (eleazar@iter.es)

La Palma (730 Km^2) is one of the youngest and most active volcanic islands of the Canarian archipelago. During the last 1 Ma, volcanic activity has been concentrated at the southern part of the island, where Cumbre Vieja volcano (220 Km^2) has been constructed. The major structural features of Cumbre Vieja volcano are three volcanic rift-zones trending N-S, NW-SE and NE-SW. During the last 60 years, two eruptions have occurred at Cumbre Vieja along the N-S rift-zone, being the most recent the Teneguía volcano (1971) at the southern part of the volcanic edifice. Since fumarolic activity is absent at the surface environment of Cumbre Vieja, diffuse CO_2 degassing surveys are a major geochemical tools for monitoring changes on volcanic activity. We have focussed our studies on diffuse CO_2 degassing because is, after water, the main volatile species in magma and has low solubility in silicate melts. Diffuse CO_2 degassing studies were carried out in 1997, 2000, 2001, 2002, 2003 and 2004 as part of the volcanic surveillance program of Cumbre Vieja. Diffuse CO_2 efflux was measured in approximately 600 observation sites at each survey and during the summer periods, after taking into consideration the local geology and accessibility. Soil CO_2 efflux measurements were performed in-situ by means of a portable NDIR sensor LICOR-800 according to the accumulation chamber method. CO_2 efflux values ranged during all this study from negligible values up to 1900 g m^2 d^{-1}. CO_2. Additionally, isotopic composition of soil CO_2 at 40 cm depth was measured in approximately 60 points for the 2000, 2001 and 2002 surveys by means of a Finnigan MAT Delta S spectrometer. The δ^{13}C-CO_2 values ranged between -54.2 per mil vs PDB and -1.5 per mil vs

PDB. CO_2 efflux contour maps of Cumbre Vieja were constructed using the Kriging as an interpolation method because it produces better results from irregularly spaced measurements. Relatively high CO_2 efflux values (>10 g m^2 d^{-1}, being the mean of the background 2 g m^2 d^{-1}) were measured along the main NS rift of Cumbre Vieja. Peak CO_2 efflux values higher than 500 g m^2 d^{-1} were mainly observed at the southern part of the N-S rift and close to Teneguía volcano. Soil CO_2 efflux values together with δ^{13}C-CO_2 values suggest that organic matter degradation is the major contributor to the observed CO_2 emission at Cumbre Vieja. The heaviest δ^{13}C-CO_2 value (-1.5 per mil vs PDB) was measured at the west area of Teneguía volcano, indicating a deep contribution for this gas from the residual magma beneath Teneguía. The total diffuse CO_2 output released to the atmosphere in a diffuse form was estimated for each survey considering the positive volume generated by interpolation, indicating that Cumbre Vieja released for the 1997-2004 period between 1144 and 2500 t d^{-1} (std dev = $\pm$ 515 t d^{-1}). The observed low variance on the total CO_2 output during this period is an useful tool to evaluate the background CO_2 emission output of Cumbre Vieja during periods of non volcanic activity.